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Original Article

Can the management of blood sugar levels in gestational diabetes mellitus cases be an indicator of maternal and fetal outcomes? The results of a prospective cohort study from India.

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BACKGROUND: **Gestational diabetes mellitus (GDM) is emerging as an important public health problem in India owing to its increasing prevalence since the last decade. The issue addressed in the study was whether the management of blood sugar levels in GDM cases can predict maternal and fetal outcomes.**

MATERIALS AND METHODS: **A prospective cohort study was done for 2 year from October1, 2012, to September 31, 2014, at 198 diabetic screening units as a part of the Gestational Diabetes Prevention and Control Project approved by the Indian Government in the district of Kanpur, state of Uttar Pradesh. A total of 57,108 pregnant women were screened during their 24-28th weeks ofpregnancy by impaired oral glucose test. All types of maternal and perinatal outcomes were followed up in both GDM and non-GDM categories in the 2nd year (2013-2014) after blood sugar levels were controlled.**

RESULTS: **It was seen that for all kinds of maternal and fetal outcomes, the differences between GDM cases and non-GDM cases were highly significant (P < 0.0001, relative risk > 1 in every case). Moreover, perinatal mortality also increased significantly from 5.7% to 8.9% when blood sugar levels increased from 199mg/dl and above. Perinatal and maternal outcomes in GDM cases were also significantly related to the control of blood sugar levels (P < 0.0001).**

CONCLUSION: **Blood sugar levels can be an indicator of maternal and perinatal morbidity and mortality in GDM cases, provided unified diagnostic criteria are used by India laboratories. However, to get an accurate picture on this issue, all factors need further study.**

It was seen that for all kinds of maternal outcomes suchas cesarean section, pregnancy-induced bypertension (PIH), premature baby unit (PBU) care, family H/O DM and antepartum hemorrhage / postpartum hemorrhage (APH / PPH), the differences between GDM and non-GDM cases were highly statistically significant (P < 0.0001, RR > 1 in every case). This was also seen in the outcomes of neonates in terms of perinatal death, stillbirth, neonatal death, congenital malformations, large gestation for age (LGA), low birth weight (LBW), jaundice. Here also the differences between GDM and non-GDM case were statistically significant (P < 0.0001, RR > 1 in every case) [Table 1].

In terms of H/O previous birth complication, again in the category of stillbirths and perinatal deaths both in GDM and non-GDM cases, the differences were statistically significant (P < 0.0001). However, in neonatal deaths, it was not significant in both GDM and non-GDM category (P > 0.05) [Table 2]

As the blood sugar level rose above 120 mg/dl, perinatal mortality rose significantly as compared to previous perinatal loss (P < 0.0001). This increased significantly from (5.7% to 8.9%) when blood sugar level was >199 mg/dl [Table 3 and Figure 1].

Table 1 : Maternal and fetal outoomes of gestational diabetes mellitus and nongestational diabetes mellitus pregnant women

Outcomes	GDM cases (n=7641) N (%)	Non-GDM cases (n=8000) N (%)	RR	95% CI	*p*-value
Stillbirth	247 (3.2)	102 (1.3)	2.53	2.0-3.1	<0.0001
Neonatal death	128 (1.7)	56 (0.7)	2.39	1.75-3.27	<0.0001
Perinatal death	375 (4.9)	158 (1.97)	2.48	2.0-2.9	<0.0001
Congenital malformation	382 (5)	82 (1.03)	4.87	3.8-6.1	<0.0001
Cesarean section	2242 (29.3)	1814 (22.67)	1.21	1.2-1.3	<0.0001
PBU Care	234 (3.06)	85 (1.06)	2.88	2.25-3.68	<0.0001
LGA	684 (9)	67 (.83)	10.6	8.3-13.7	<0.0001
LBW	863 (11.3)	758 (9.4)	1.19	1.1-1.3	<0.0002
PIH	686 (9)	463 (6)	1.83	1.6-2.0	<0.0001
Jaundice	382 (5)	84 (1)	4.76	3.7-6.0	<0.0001
Family history of DM	1372 (17.9)	546 (6.8)	2.62	2.3-2.8	<0.0001
APH/PPH	64 (.8.64)	26 (0.32)	2.57	1.6-4.0	<0.0001

APH : Antepartum hemorrhage, PPH : Postpartum hemorrhage; PIH : Pregnancy-Induced hypertension; LBW: Low birth weight; LGA: Low gestation for age; PBU: Premature baby unit; OR : Odds ratio, RR : Relative risk; DM : Diabetes mellitus; GDM : Ges : Gestational diabetes mellitus

Table 2 : Fetal outoomes in gestational diabetes mellitus versus nongestational diabetes mellitus and its relationship with history of previous birth complications

Outcomes in neonate	GDM cases (n=7641) N (%)	Previous fetal loss present N (%)	*p*- value	GDM absent (n=8000) N (%)	Previous fetal loss present N (%)	*p*- value
Stillbirth	247 (3.2)	916 (12)	<0.0001	102 (1.2)	212 (2.6)	<0.0001
Neonatal death	128 (1.7)	156 (2)	<0.09	56 (0.7)	62 (0.8)	<0.5
Perinatal death	375 (4.9)	1072 (14)	<0.0001	158 (1.9)	274 (3.4)	<0.0001

GDM : Gestational diabetes mellitus

Table 3 : Perinatal mortality as a function of blood sugar (mg/dl) vbalue and its comparison with a history of previous perinatal loss

Blood gugar levels (mg/dl)	Samples tested (n=57,018	Perinatal mortality present *N* (%)	History of previous perinatal mortality *N* (%)	*p*-value
<100	n1=12,560	-	-	-
100-119	n2=31,575	776 (2.4)	768 (2.5)	<0.44
120-139	n3= 5742	137 (2.4)	214 (3.7)	<0.0001
140-159	n4=2813	137 (3.5)	417 (10)	<0.0001
160-179	n5=1451	65 (4.4)	176 (12.1)	<0.0001
180-199	n6 = 940	54 (5.7)	168 (17.8)	<0.0001
≥200	n7=1338	119 (8.9)	311 (23.2)	<0.0001

The most important finding in our study was that as blood sugar levels rose above 120 mg/dl, there was significant perinatal mortality compared to previous perinatal loss (P<0.0001). This perinatal loss increased significantly from (5.7% to 8.9%), when blood sugar levels was ³ 199 mg/dl. This finding was also unique in contrast to many related studies. [18-26] It has been seen that the values of oral glucose tolerance test in the middle phase of pregnancy and antenatal random glycemia can to some extent also predict PIH, preterm births, or stillbirths. [26]

DISCUSSION

DM is increasing worldwide and this rise is more prevalent in developing countries such as India, which is going to become the future "Diabetic-Capital," for which GDM is thought be a real contributor[12]. This emphasizes the importance of prevalence studies in India in pregnant women in order to reveal the exact prevalence of GDM. [12] Hence, GDM is emerging as a rising public health problem in pregnant women in India as many studies have indicated. [5,12-15]

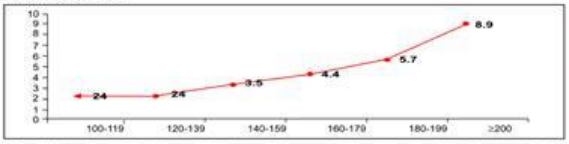

Figure 1 : Perinatal mortality (%) in gestational diabetes mellitus cases in relation to the maternal blood sugar levels (in g/dl)

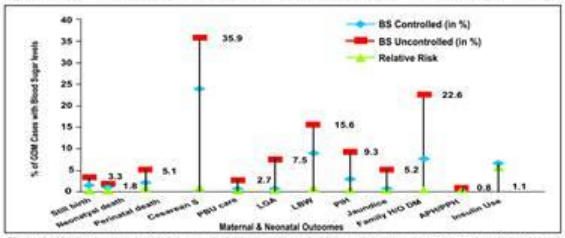

Figure 2 : Maternal and perinatal outcomes (in %) in gestations diabetes mellitus cases in relation to the maternal blood sugar levels controlled by treatment (in g/dl).

Table 4 : Post follow-up complications of gestational diabetes diagnosed in controlled and uncontrolled blood sugar after treatment

Maternal and neonatal outcomes	BS-controlled (<140mg%) (n=4589) *N* (%)	BS-uncontrolled (>140 mg%) (n=454) *N* (%)	RR	95% CI	*p*-value
Stillbirth	64 (1.4)	15 (3.3)	0.42	2.0-3.1	<0.0023
Neonatal death	37 (0.8)	8 (1.8)	0.84	30.28-0.98	<0.043
Perinatal death	101 (2.19)	23 (5.1)	0.43	0.28-0.68	<0.0002
Congenital malformation	206 (4.5)	22 (4.8)	0.93	0.60-1.4	(=0.73
Cesarean section	1161 (24.6)	163 (35.9)	0.67	0.58-0.76	<0.0001
PBU Care	27 (0.59)	12 (2.75)	0.22	0.11-0.44	<0.0001
LGA	30 (.65)	34 (7.5)	0.087	0.054-0.14	<0.0001
LBW	413 (8.9)	71 (15.6)	0.57	0.46-0.73	<0.0001
PIH	137 (2.98)	42 (9.3)	0.32	0.23-0.45	<0.0001
Jaundice	26 (0.56)	24 (5.2)	0.11	0.062-0.18	<0.0001
Family history of DM	357 (7.7)	103 (22.6)	0.34	0.28-0.41	<0.0001
APH/PPH	11 (0.23)	4 (0.88)	0.27	0.087-0.85	<0.025
Insulin use	298 (6.4)	5 (1.1)	5.89	2.4-14.1	<0.0001

APH : Antepartum hemorrhage, PPH : Postpartum hemorrhage; PIH : Pregnancy-Induced hypertension; LBW: Low birth weight; LGA: Low gestation for age; PBU: Prematurebaby unit; BS : Blood Sugar; OR: Odds ratio; RR: Relative risk; DM: Diabetes mellitus

CONCLUSION

Maternal and fetal outcomes in GDM cases are poor. Perinatal and maternal outcomes in GDM cases are also signficantly related to control or blood sugar levels. Therefore, blood sugar levels appear to be an important possible indicator of maternal and perinatal morbidity and mortality in Indian GDM cases. However, there is a need to unify diagnostic criteria in practices throughout the Indian subcontinent for a better validation of results from this study as well as other GDM studies conducted in India.

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